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Conducting Dermatological Operations in Patients Who Have Previously Undergone Cardiac Surgery

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Authors' contributions

This work was carried out in collaboration among all authors. Authors ANI and RSOS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors RGK and DTA managed the analyses of the study. Authors PVN and VVG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Thoracic surgical procedures and the use of cardiac devices such as pacemakers are becoming increasingly common in the population. Therefore, dermatologists may be more likely to encounter previously implanted or discarded surgical material during a dermatological operation on the chest wall. A basic understanding of the types of wires and tunneling paths used in such procedures is essential to accurately predict the presence of these wires and effectively manage any chance encounters.

Dermatologists should be aware that temporary epicardial pacemaker electrodes and pacemaker electrodes often remain in the chest wall of many patients. All patients with a history of cardiac

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surgery should be asked about the possible presence of temporary epicardial electrodes in their body, and if such materials are found during the operation, it is necessary to immediately stop the procedure and do not undertake further manipulations with them until the material from which it is made is determined.
Specialists in cardiology and cardiothoracic surgery need to document any abandoned wire in the patient's list of problems and inform the patient about the abandoned wire so that he or she can be an important source of clinical information.
Trying to pull out the remaining pacemaker electrodes is a serious risk, so dermatologist surgeons should not attempt it under any circumstances. When detecting wire material, it is necessary to determine the type and location of the material before any manipulation or pulling attempts. Once it is established that this is a non-functional, abandoned wire, it is necessary to apply the correct technique for removing it, which consists in gently pulling and securing the wire at the exit point. Accurate identification of the material is required in order not to interfere with the operation of the active device and not to abandon the operation unnecessarily.
The aim of the work is to consider the implementation of dermatological operations in patients who have previously undergone cardiac surgery.

Keywords: Dermatological operations; thoracic surgery; cardiac surgery.

1. INTRODUCTION

Conducting dermatological operations is associated with a number of problems that arise for various reasons. However, the most important point in this aspect, in our opinion, is the previously performed surgical cardiac interventions. As cardiac surgery becomes more common due to an aging population and new advances in the diagnosis and treatment of heart disease, dermatologists and dermatological surgeons encounter many patients with a history of cardiac surgery. These patients may have had implanted cardiac devices, such as pacemakers and implantable cardioverter defibrillators (ICDs) [1]. The literature describes the possible complications that may occur and the precautions that must be taken when performing dermatological surgery with the simultaneous use of electrosurgery in these patients. However, there is very little data on the problems that may arise when maintaining temporary cardiology equipment [2].

So, in one of the sources, it was noted that surgeons found a wire material enclosed in a tumor during the Mohs micrographic operation on the chest wall in a patient with an active pacemaker and having a history of cardiac surgery. The wire was found during the examination of the tumor [3]. It was determined that this wire is conductive. To diagnose the patient's condition, a chest X-ray (CXR) was performed and a cardiologist was consulted.

It was revealed that the spoke was held from a temporary epicardial pacemaker installed after cardiac surgery and deliberately left when it was no longer needed. Similar medical cases, as well as the algorithm of action in such situations, were not available in the literature. The authors conducting the operation found that in addition to ICDs and pacemakers, the presence of which is usually obvious due to the presence of a visible implanted generator on the chest wall, dermatologists and dermatological surgeons may encounter other types of materials used in open heart surgery [4,5].

Accordingly, it is quite relevant to review the above materials to help medical professionals identify foreign material that may be encountered during surgery, and to minimize the potential danger to patients during the procedures and to diagnose skin lesions that may occur again due to the presence of residual particles of the material.

The aim of the work is to consider the implementation of dermatological operations in patients who have previously undergone cardiac surgery.

2. RESEARCH METHODS

In the process of writing the work, an array of literature was studied within the framework of the defined topic, and a comparative method was also used.

3. RESULTS

Many cardiac surgeons typically insert temporary epicardial pacemakers (TEPWS) after open-

heart surgery (such as valve replacement or correction, coronary artery bypass grafting, or heart transplantation) for both therapeutic and diagnostic purposes due to the increased postoperative risk of myocardial dysfunction [6].

TEPWS are typically stainless steel monofilament wires with an insulating coating running from the epicardial starting point through the skin to the right and left of the sternum, for pairs of atrial and ventricular wires, respectively. They are usually removed 2-7 days after the operation by careful stretching. If excessive resistance occurs during the removal of the wire or the patient is at increased risk of bleeding due to coagulopathy, the wire may be left in place at the discretion of the surgeon. Some surgeons may also intentionally sew up the TEPW tightly for better contact with the epicardium and more reliable pulse delivery in critical situations, sometimes even with the intention of intentionally discarding the wire.

Temporary transvenous stimulation electrodes (TTPWS) are also used for short-term stimulation, but are usually only used as a temporary bridge to permanent stimulation in acute conditions, such as high-grade symptomatic heart block. Although TTPW and a permanent cardiac pacemaker, in general, are very similar in placement, there are minor differences in the insertion methods and final placement of the ends in contact with the pulse generator [7].

A permanent cardiac pacemaker consists of three components: a pulse generator, electrodes, and wires (the last two form the connection leads). Unlike TTPW, permanent pacemaker leads are inserted into the subclavian bone, but are first tunneled subcutaneously to create space for the pulse generator to be placed under the skin.

TTPWS are inserted directly into the central veins – most commonly the internal jugular or subclavian veins-via a catheter and contain an inflatable balloon tip that helps secure the open conducting tip in the right atrium or ventricle before connecting to an external pulse generator.

Similar to the TEPW, they also consist of a stainless steel core with an insulating plastic sleeve, but they have a larger gauge due to the additional channel required to inflate the balloon armature. During the installation of a permanent pacemaker or pacemaker, the TTPWS are replaced with more permanent pacemaker conductors. According to the literature, the authors have a negative attitude to cases of TTPW left in the body of patients [8].

A permanent pacemaker (ICD) consists of three components: a pulse generator, electrodes, and wires (the latter two form the connecting pins). Unlike TTPW, ICD leads or permanent pacemaker leads are inserted into the subclavian bone, but are first tunneled subcutaneously to create space for the pulse generator to be placed under the skin. Although they are most often placed in the upper left quadrant of the chest wall due to anatomical features, the pulse generator (and wires) can sometimes also be found on the right.

The implanted pacemaker generator or unit is visible under the skin on the chest wall and therefore indicates the presence of adjacent subcutaneous wires for stimulation. Implanted pulse generators can be removed in special cases, such as infection, rejection by the body, or equipment malfunction. For patients who have used a pacemaker or ICD for a long time, it is not uncommon to have several "abandoned" non-functional leads for the pacemaker due to electrode failure or changes in the rhythm generator.

Most invasive cardiac surgeries require a median sternotomy for access, which must later be closed with a high-strength material to re-approach the sternal margin.

Alternatives to traditional breast wire suturing include the use of stainless steel bands, polymer bands (such as Ethicon), or absorbable sutures (usually in young patients), either alone or in combination with sternal wire [9].

The sternal spokes are made of non-insulated surgical stainless steel, attached to the suture needle to facilitate thread refilling. The wires are usually left behind after installation, but sometimes they are removed for reasons such as irritation, infection, or a faulty wire. These wires can break or migrate closer to the surface of the skin, where they are sometimes found in the dermis or even exit through the epidermis [10].

Various temporary pacing electrodes, as well as permanent or semi-permanent electrodes, can have negative effects on the body. Common to all types of wires is the risk of infection,

migration, or rupture, with consequences ranging from local irritation and abscess formation to significant cardiopulmonary events, including arrhythmia, hemothorax, cardiac tamponade, and subclavian vein occlusion or thrombosis.

In this regard, the occurrence of migration of the external fragment, causing associated skin changes, is of particular interest to dermatologists. Patients may have the following complications due to the migrating wire material: skin node, hematoma, infectious disease, foreign body granuloma, fistula.

4. DISCUSSION

Any patient following open-heart surgery should have a high degree of suspicion in the presence of dermatological changes in the areas tracked along the various conduits. A basic understanding of the types of wires and tunnel paths used and explained earlier can provide insight into the potential etiology of such skin findings in these patients.

In one case, a 77-year-old man complained of an increasing mass on the right neck near the lower attachment of the sternocleidomastoid muscle, identified as a hematoma caused by a migrating fragment of sternal wire, 6 years after the aortic valve was repaired.

Another source describes a 77-year-old man who had undergone open-heart surgery 8 years earlier, complaining of intermittent bleeding for 19 months, an irritated skin node in the left middle part of the lower chest, which was later discovered to be the result of a migrating preserved TEPW.

Similarly, foreign body granulomas, fistulas, and local infections have been described as a direct result of TEPW, pacemaker or defibrillator leads, and sternal wires [11].

Dermatologists should also be aware of these commonly used materials, as they may occur during skin surgery on the chest wall in patients after cardiac surgery. The current literature examines the general surgical aspects in the operation of persons with pacemakers or ICDs, and offers logical recommendations for perioperative monitoring due to concerns about a malfunction of the pacemaker, reprogramming of the device, or a very serious potential complication of asystole.

Some authors found that although skin surgeons using electrosurgical equipment did not report serious adverse outcomes, cardiac complications such as missed beats or incorrect ICD triggering were observed with a frequency of 10 to 30% during dermatological procedures on the chest wall [12].

Other authors performed a retrospective review at the Mayo Clinic of 173 patients with pacemakers and 13 patients with ICD who underwent dermatological surgery; the authors concluded that there were no documented complications associated with bipolar electrosurgery [13].

Further complicating this problem is the fact that many postoperative patients with retention wire often do not know that the specified material was not extracted by the doctor.

It can be assumed that, although there are excellent safety indicators, the generally recognized risk of performing skin surgery using electrosurgical equipment applies not only to patients with implanted active cardiac devices, but also includes patients with any cardiac history and possible preserved pacemaker conductors.

While the material discussed above is often expected to be found in the tissues of those with implanted cardiac devices, it is not expected to be found in those with a history of only cardiac surgery without the implanted device [14].

Further complicating this problem is the fact that many postoperative patients with retention wire are often unaware of such abandoned material. In particular, when a stored pacemaker wire is found during surgery, the presence of the wire is usually not recorded in any available medical records. The patient is also not informed about the wire to verbally report its presence. These wires can pose a clear danger to patients during skin procedures using electrosurgery, as they represent a conductive pathway leading directly to the myocardium, especially at the exposed end of the wire or anywhere along it where the insulating coating may be broken or damaged.

Caution should be exercised when working near known locations of the wire path, but contact with the wire may be unavoidable in cases of skin growths lying on top of or covering a segment of the held wire. It is quite difficult to remove stimulation electrodes left for more than 1 week

(temporary or permanent), as the risk of complications such as atrial or ventricular rupture, hemorrhage, tamponade, and damage to the coronary vasculature increases. Consequently, the threshold for rejection of pacemaker wires is quite low, since the retained wires are usually very well tolerated, and the risk profile for removal is often unacceptably high [15].

Removal of pacemaker wires beyond the normal installation time for temporary wires is usually not performed, except in rare cases, such as systemic infection, lead-related endocarditis, or thrombotic complications (such as superior vena cava syndrome with transvenous leads), when there is a risk associated with complete removal of the electrodes. Removal in such cases is carried out under strictly controlled conditions using telemetry, specialized removal tools, and the necessary equipment to treat any reported complications.

When the decision is made to discard the pacemaker wires, excess sagging is eliminated before cutting the wires flush with the skin, while simultaneously providing counteraction to the pull force with downward pressure on the surrounding skin. This causes the retained part to retract under the skin and allows the tract to heal, providing a greater degree of protection against infection going through the conductor to the myocardium [16].

Wire removal is usually performed after the chest plate is stabilized. In rare cases where broken and remaining fragments cause irritation, these fragments can be removed to prevent further damage to the surrounding tissues, just like removing any other small foreign body. Removing sternal wires does not cause the same heart problems as pacemaker wires, since the wires installed in the sternum do not carry the same potential damage to the myocardium or conduct an electrical charge to the myocardium.

The main distinguishing factor between pacemaker conductors and chest conductors is the presence of an insulating sheath over the conductive core (usually stainless steel) with TEPW, TTPW, and permanent pacemaker leads. or pacemakers. Despite the fact that sternal wires are also made of stainless steel, these wires do not have an insulating shell, and they usually do not reach the myocardium [17].

Cardiac devices, such as pacemakers, and cardiothoracic procedures, including valve repair or replacement, coronary artery bypass grafting, and heart transplant operations, are becoming increasingly common in the population. It is important to know that TEPWS are usually administered after these operations, and sometimes they are intentionally left and left in the chest wall, where they can be detected during dermatological procedures [18].

The presence of a pacemaker or ICD indicates the presence of wires for pacemakers, but the condition of many people after heart surgery without any such devices may still contain a wire that can cause skin symptoms or complications during dermatological procedures in the area of the wires. Thus, a high degree of suspicion should be maintained for anyone who has a history of open-heart surgery, has a scar after a ternotomy, or has a scar from the installation of a pacemaker or ICD.

Cardiac devices, such as pacemakers, and cardiothoracic procedures, including valve repair or replacement, coronary artery bypass grafting, and heart transplant operations, are becoming increasingly common in the population. It is important to know that TEPWS are usually administered after these operations, and sometimes they are intentionally left in the chest wall, where they can be detected during dermatological procedures. [19].

Patients with a history of cardiac surgery can easily be asked about the remaining wire material before dermatological surgery on the chest wall. However, most patients will not know if such a wire was used or abandoned. Although X-rays can be performed to confirm the presence and passage of the abandoned wire, in the presence of chest wires or other pacemaker wires, full tracking of the course of any of the wires may be difficult or impossible.

The unexpected discovery of leftover pacemaker wire during skin procedures is a rare and disturbing discovery. Common preoperative suggestions include collecting a complete medical history with screening of patients and predicting the types and locations of potentially retained wire in individuals who may have it. If a wire is found in the chest wall during the operation, the following rules must be observed:

1. Do not pull the wire with force and try to pull it out.

2. Stop the procedure immediately until the type of wire is found out.
3. It is necessary to ask the patient about past possible cardiac procedures.
4. It is necessary to perform an X-ray examination to assess the direction and nature of the wire.
5. It is necessary to involve a cardiologist or a cardiac surgeon for consultation, if the map review and radiography do not determine the nature and direction of the wires.

5. CONCLUSIONS

Specialists in cardiology and cardiothoracic surgery need to document any abandoned wire in the patient's list of problems and inform the patient about the abandoned wire so that he or she can be an important source of clinical information.

Trying to pull out the remaining pacemaker electrodes is a serious risk, so dermatologist surgeons should not attempt it under any circumstances. When detecting wire material, it is necessary to determine the type and location of the material before any manipulation or pulling attempts. Once it is established that this is a non-functional, abandoned wire, it is necessary to apply the correct technique for removing it, which consists in gently pulling and securing the wire at the exit point. Accurate identification of the material is required in order not to interfere with the operation of the active device and not to abandon the operation unnecessarily.

CONSENT

It's not applicable.

ETHICAL APPROVAL

It's not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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